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ABSTRACT

This study examined the relationship between convergent and divergent thinking and performance errors in reversal and nonreversal concept tasks. The results show: (1) a positive relationship between convergent performance and concept errors; and (2) an inverse relationship between divergent performance and concept errors. These correlational patterns were most evident in relation to errors occurring for the shift problems of both the reversal and nonreversal tasks. A global measure of intelligence was not associated with concept errors. In interpreting the findings, divergent and convergent behaviors are viewed as corresponding respectively to dispositions toward flexibility and rigidity in processing conceptual information. (Author)

Some Cognitive Correlates of Reversal-Nonreversal Learning

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Research using the reversal-nonreversal learning paradigm has typically shown considerable performance variability. Presumably subject variables such as intelligence might account for at least some of this performance variance. However, Wolff, (1967) in reviewing a number of studies has noted no consistent relationship between speed of concept attainment (involving either a reversal or nonreversal problem) and intelligence involving subjects (Ss) ranging from retardates to normals.

Perhaps one reason for these equivocal findings is that intelligence has typically been conceptualized as a global process thereby eliminating the possibility of examining more specific cognitive variables which might provide more precise causal linkages to concept learning. In the present investigation, attention was thus directed to two specific intellectual operations -- namely, divergent and convergent thinking -- as major study variables.

Consdiering the assumption by Guilford (1967) that divergent and convergent operations represent significant intellectual domains, it might be expected that these cognitive properties, when appropriately operationalized, would have relational implications for conceptual attainment. Accordingly, the present study was undertaken to provide data on the extent and pattern of the relationship between divergent and convergent operations and reversal and nonreversal concept learning.

Method

Subjects. The Ss consisted of 120 middle class children between the ages of 12-13 with an IQ range between 90-135. The sample was divided evenly between boys and girls.

Stimulus material. The Object Sorting Task (OST), a task requiring both perceptual and verbal skills, was used in assessing divergent and convergent behavior (Safford, 1967; Dunn, 1969). Using the OST on a divergent basis, S is required to classify the six plastic objects comprising the task into two dichotomous groups in as many different ways as possible. After each classification, S is asked why he has grouped the objects in a particular fashion. There are nine orthogonal dimensions by which the OST may be meaningfully classified.

Using the OST on a convergent basis, the experimenter presents S with each possible dichotomous sort. For each convergent presentation, S is asked to explain why the objects were dichotomized in a particular fashion.

The sample was randomly assigned to either a divergent (N=60) or convergent (N=60) assessment. The two groups were further divided such that half of each group received reversal training and the other half nonreversal training. Altogether four groups (each with N=30) were formed on a random assignment basis: divergent assessment reversal training (DR); divergent assessment-nonreversal training (DNR); convergent assessment-reversal training (CR); and convergent assessment-nonreversal training (CNR).

Responses to the OST were collected first followed after five days by the administration of either the reversal or nonreversal task. In the reversal situation S was shown 24 cards on which were drawn figures varying along the following dimensions: (a) shape; (b) color; (c) number of drawn figures on a card; (d) dot. Dimensions c and d always served as irrelevant properties during concept learning.

For the reversal conditions (DR and CR) S shifted within the shape dimension from circularity (problem one) to squareness (problem two). In the nonreversal conditions (DNR and CNR), colc. served as the relevant dimension in problem one and shape as the relevant dimension for the shift problem. For both the reversal and nonreversal conditions, the learning criterion for problems one and two was ten consecutive correct responses. Approximately four months prior to the collection of these data, an intellectual assessment was obtained for these subjects, using the California Test of Mental Maturity.

Results

The major findings of this study are reported in Table 1. Convergent behavior was found to be positively associated with total errors on both problems one and two for the CR and CNR groups.

Insert Table 1 here

This correlational pattern was more evident on the shift problem, particularly the significant positive correlation for the CNR group. In contrast, divergent performance was inversely correlated with total errors on the concept tasks. This relationship was strongest for the shift problem for both the DR and DNR groups. Table 1 further shows that significant correlations involving either the convergent or divergent assessment remain relatively unchanged after the relationship between errors on problems one and two (inter-trial performance) is partialled out.

Table 2 lists the correlations between IQ, convergent or

Insert Table 2 here

divergent performance and concept errors. The intellectual assessment showed only scant relationship to convergent or divergent behavior. Further, there were only negligible correlations between IQ and concept errors. The correlations between convergent or divergent performance and concept errors remains relatively unchanged when intelligence is partialled out.

Discussion

The contrasting relationships involving divergent and convergent skills might be explained by assuming these behaviors represent relatively distinctive styles in processing conceptual information. Thus, divergent skills may reflect a flexible cognitive style involving subject dispostions to produce multiple classifications of conceptual input. Skill in generating of multiple categorizations would seem most facilitating in solving a shift problem, a situation in which S must alter his initial conceptual scheme (problem 1) to achieve a shift solution. Consistent with this interpretation were the significant inverse correlations noted between divergent performance and errors on the shift problem for both the DR and DNR groups.

The finding that convergent performance tended to be positively associated with concept errors suggests that Ss who were successful in convergent operations may have dispositions toward rigidity in changing the basis by which concept information is categorized. The strongest evidence for this conclusion comes from the significant correlation between convergent skills and performance on the nonreversal shift problem. Subject dispositions toward cognitive rigidity might particularly interfere with performance on a nonreversal shift problem which, in comparison to a reversal task, involves a more extensive conceptual alteration from the initial problem -- i.e., by requiring S to utilize for the shift solution an entirely different conceptual dimension rather than the same dimension as in a reversal shift.

The results further show the absence of any significant association between measured intelligence and performance on a specific learning task. The absence of such a relationship further reinforces the conclusion of Wolff (1967) and Jensen (1963) of the possible limitations of global intelligence as a predictor of specific learning abilities. In contrast the present findings suggest promise in the utilization of specific cognitive variables in predicting at least at a moderate level to conceptual learning.

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TABLE I

CORRELATIONS BETWEEN DIVERGENT OR CONVERGENT PERFORMANCE AND CONCEPT ERRORS[1]

GROUPS

	DR (N=30)		CR (N=30)		DNR (N=30)		CNR (N=30)	
Problem 1	-.326	(-.250)	+.296	(+.209)	-.396	(-.293)	+.287	(+.193)
Problem 2	-.463**	(-.420)	+.389*	(+.332)	-.546**	(-.493)	+.448*	(+.401)
(Correlation between errors on Problems 1 & 2)	+.241		+.289		+.296		+.275	

1 The figures in parentheses are partial correlations between concept errors and divergent or convergent performance, holding constant the relationship between errors on problems 1 and 2.
* p>.05, 28 df, two-tail test.
** p>.01, 28 df, two-tail test.

TABLE II

CORRELATIONS BETWEEN INTELLIGENCE AND CONCEPT ERRORS[1]

GROUPS

	DR (N=30)	CR (N=30)	DNR (N=30)	CNR (N=30)
Problem 1	-.162 (-.307)	-.106 (+.288)	-.216 (-.376)	+.143 (+.273)
Problem 2	+.094 (-.457)	-.063 (+.388)	-.073 (-.548)	-.108 (+.442)
(Correlation between IQ and divergent or convergent performance)	+.156	+.124	+.194	+.175

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1 The figures in parentheses are partial correlations between convergent or divergent performance and concept errors when intelligence is held constant.